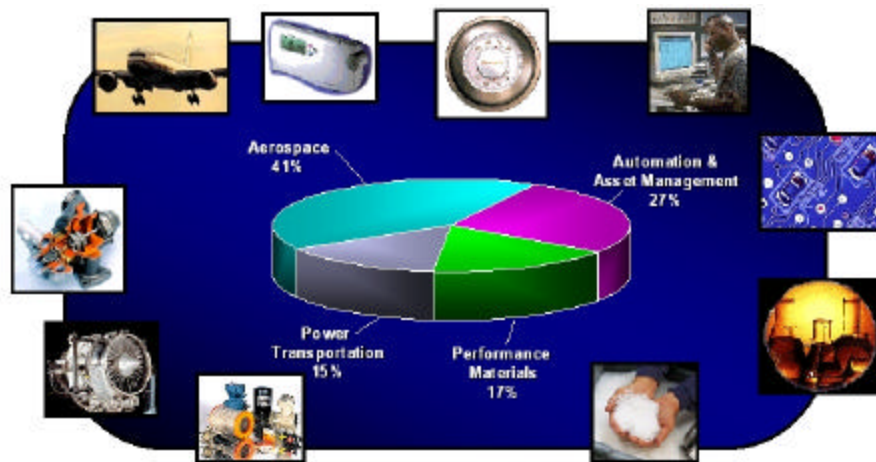


## Honeywell Solid Oxide Fuel Cells Markets and Technology Status

Nguyen Minh  
Honeywell Engines & Systems  
Torrance, CA

SECA Workshop  
Baltimore, MD  
June 1-2, 2000

### The New Honeywell: A Broader-Based Company



**Increased diversification = increased product offerings**

## Approaches to SOFC Technology

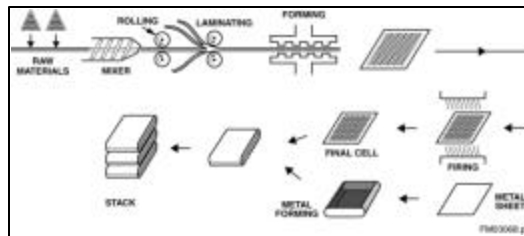
- Light weight and small size
- High performance
- Modularity
- Fuel flexibility
- Low-cost manufacturing and material

SECA Meeting  
June 1, 2000

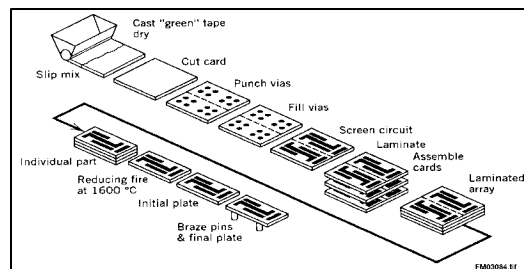
Honeywell  
SECA.ppt- 3

## Low Cost Manufacturing Process

- Stack fabrication process with tape calendering



- Multilayer electronics fabrication process



SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 4

## SOFC Applications



**Portable**  
e.g. emergency, remote, recreational



**Military**  
e.g. battery charger, APUs, motive power



**Transportation**  
APUs

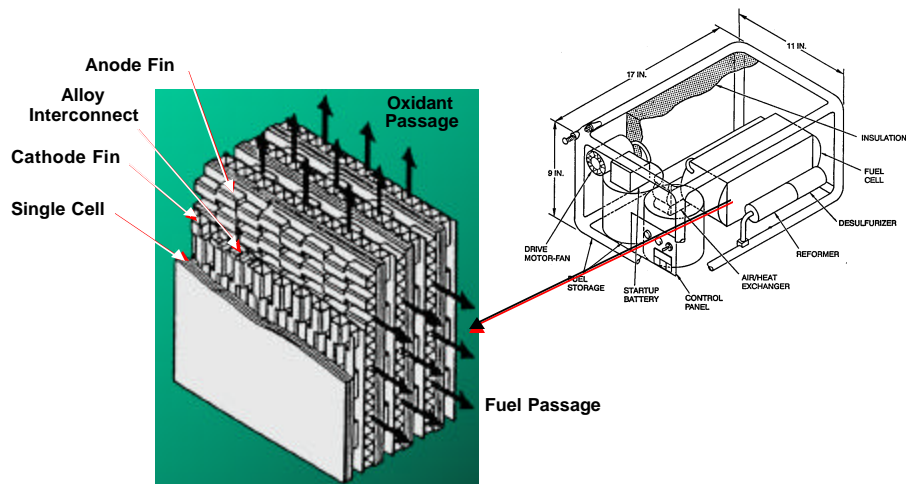


**Stationary**  
e.g. residential, distributed, central

SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 5

## Solid Oxide Fuel Cell Battery Charger



SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 6

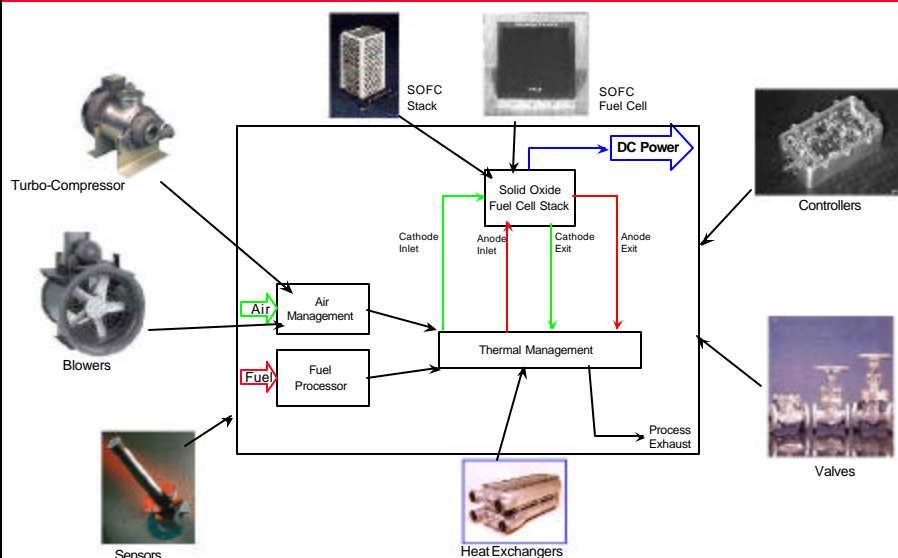
## Honeywell Portable Demonstration Unit



SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 7

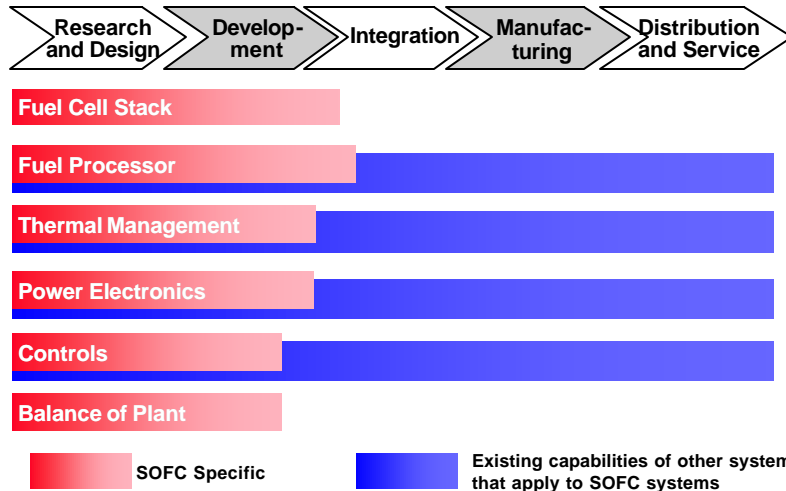
## Solid Oxide Fuel Cell System Solutions



SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 8

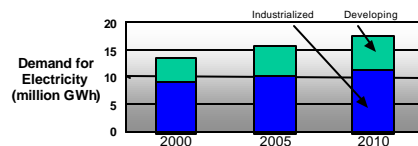
## Planar SOFC Products - Status of Development



SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 9

## Stationary Power Growth



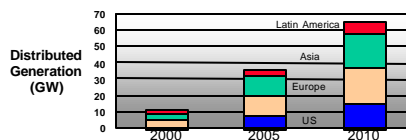
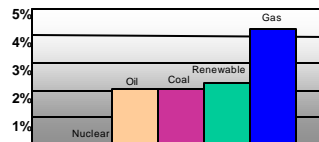
Demand for Electricity is Growing

3%  
CAGR

Natural Gas-Based Generation is Leading the Growth

4.3%  
CAGR

Growth by Generation Fuel Type (2000-2010)



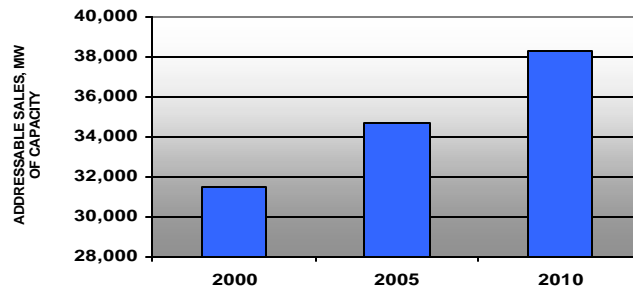
Distributed Generation is High Growth

20%  
CAGR

SECA Meeting  
June 1, 2000

Honeywell  
SECA.ppt- 10

## Addressable Stationary Power Market for SOFCs



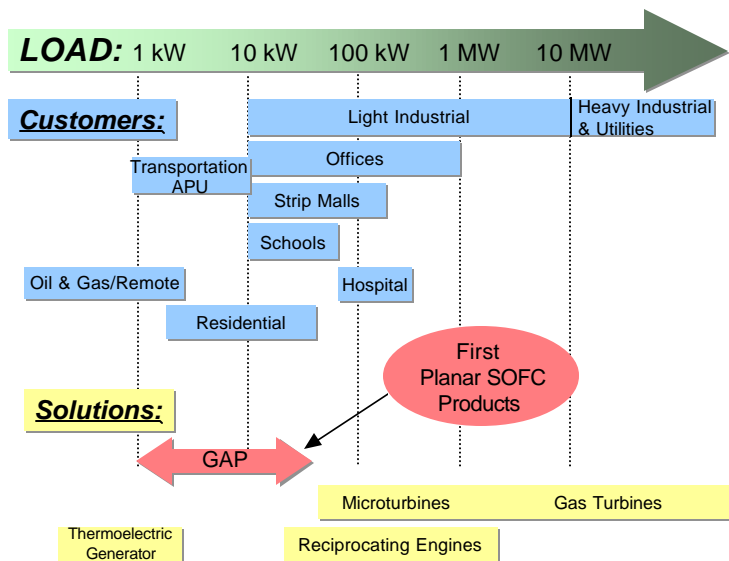
### DATA SOURCES

- US Department of Energy data
- Arthur D. Little study
- Technomics study
- Escovale study
- Oberman Associates study

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Honeywell  
SECA.ppt- 11

## Potential Entry Market



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June 1, 2000

Honeywell  
SECA.ppt- 12

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## Concluding Remarks

- Honeywell has been developing low-cost, high-performance planar SOFC technology for a broad spectrum of power generation applications
- Honeywell has developed business plans and technology roadmaps to commercialize SOFC products